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3           UNITED STATES PATENT APPLICATION

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6       METHOD, COMPUTER PROGRAM PRODUCT AND SYSTEM FOR PROVIDING A  
7       SWITCH USER FUNCTIONALITY IN AN INFORMATION TECHNOLOGICAL  
8       NETWORK

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2 FIELD OF THE INVENTION  
34 The present invention relates generally to server-agent environments, and  
5 more particularly to a method, a computer program product and a system for  
6 providing a switch user functionality in such an environment.  
78 BACKGROUND OF THE INVENTION  
910 Nowadays, as information systems become ubiquitous, and companies and  
11 organizations of all sectors become dependent on their computing resources, the  
12 requirement for the availability of the hardware components and software  
13 components (applications) of an IT network and of services based on it,  
14 (hereinafter all three are generally referred to as "objects") is increasing while  
15 the complexity of IT networks is growing.16 There are network management systems available which enable the  
17 availability and performance of objects within an IT network to be monitored and  
18 managed. For example, Hewlett-Packard offers such network monitoring and  
19 managing tool, which is a server-based, under the name "OpenView". The  
20 product is available for Windows and Unix operating systems. It comprises a  
21 management server, a user interface to operate the server and several "agents"  
22 for different operating-system platforms. An agent is a program or process  
23 which runs on a managed node. A personal computer, network node (in the  
24 narrow sense) or any system with a CPU is called a node. A managed node is a  
25 node which is monitored and/or managed by the management system.26 In order to allow the users of such a system to react to network problems,  
27 the agents implement a feature which enables software tools or applications to  
28 be started remotely. For example, if the operator of the system detects a  
29 possible problem on the monitored node, he can, via the management server and

1 using the user interface, initiate the start of a software tool on the monitored  
2 node which carries out diagnosis, recovery, repair and/or reconfiguration  
3 actions.

4 Often, such a tool must be started using a different user account than the  
5 account of the operator. To achieve this, the agent has a built-in "switch user"  
6 functionality which allows the operator to change his account to the user  
7 account which is needed. To use this functionality on Windows NT systems, the  
8 agent calls a Windows NT application programming interface (API) in a particular  
9 way which is not transparent for normal users, e.g. by including a certain code  
10 which is generated by the agent software independent and is independent from  
11 the account to which the switch user is to be performed. The call will be  
12 forwarded to the Windows NT domain controller. A sub-authentication  
13 component (a dynamic link library (DLL) component), which extends the  
14 standard Windows NT user name and password authentication component on  
15 the domain controller, will receive that call and verify that the call has been  
16 performed in the correct way, e.g. by checking the code word (the standard  
17 Windows NT authentication component is, for example, described in Microsoft  
18 Windows 2000 Security Technical Reference, Redmond, 2000, pages 22-23 and  
19 154-155). If the check reveals that the call has been made correctly, it will allow  
20 the agent to perform the switch user to the requested account. The password of  
21 the account is not needed by the agent or the domain controller to perform the  
22 user switch.

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#### 24 SUMMARY OF THE INVENTION

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26 The invention provides a method for providing a switch user functionality in  
27 a server-agent environment in an information technological (IT) network. At least  
28 one agent runs on a node of the IT network. The method comprises the  
29 following steps: generating a switch user (SU) certificate using public-key

1 cryptography upon receiving a request to switch from a user account presently  
2 used on the node to another user account; sending the SU certificate to the  
3 agent; checking the correctness of the SU certificate; performing the requested  
4 switch to the user account provided that the SU certificate is correct.

5 According to another aspect, the invention provides a computer program  
6 product including program code for providing a switch user functionality in a  
7 server-agent environment in an information technological (IT) network, in which  
8 at least one agent runs on a node of the IT network. Said program code is for:  
9 generating a switch user (SU) certificate using public-key cryptography upon  
10 receiving a request to switch from a user account presently used on the node to  
11 another user account; sending the SU certificate to the agent; checking the  
12 correctness of the SU certificate; performing the requested switch to the user  
13 account provided that the SU certificate is correct.

14 According to still another aspect, the invention is directed to a system for  
15 managing objects in an information technological (IT) network having a network  
16 management server and at least one management agent which runs on a  
17 managed node of the IT network. The system provides a switch user  
18 functionality. It comprises: an SU certificate generation component which uses  
19 public-key cryptography; an SU certificate sending component which sends the  
20 certificate to the agent; an SU certificate checking component; a user account  
21 switching component performing the requested switch provided that the SU  
22 certificate is correct.

23 Other features are inherent in the system, computer program product and  
24 method disclosed or will become apparent to those skilled in the art from the  
25 following detailed description of embodiments and its accompanying drawings.

## DESCRIPTION OF THE DRAWINGS

29 In the accompanying drawings:

1       Fig. 1     shows a high-level architecture diagram of an object managing  
2 system which provides a switch user functionality;

3       Fig. 2     illustrates the generation and checking of an SU certificate  
4 according to a first embodiment;

5       Fig. 3     illustrates the generation and checking of an SU certificate  
6 according to a second embodiment;

7       Fig. 4     is a flow chart of a switch user certificate method using the  
8 generation and checking method of fig. 3.

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## 10                  DESCRIPTION OF THE PREFERRED EMBODIMENTS

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12       Fig. 1 shows a high-level architecture diagram of a preferred embodiment.  
13 Before proceeding further with the description, however, a few items of the  
14 preferred embodiments will be discussed.

15       In the preferred embodiments, a switch user functionality is provided in a  
16 server-agent environment in an IT network, such as a computer network or a  
17 telecommunication network. A node is a network object such as a PC, network  
18 node (in the narrow sense) or any system with a CPU. An agent is a program or  
19 process running remotely on a node. For example, an agent may be able to  
20 respond to requests from the server relating to the node or an application  
21 residing on it, perform operations and/or send notifications to the server relating  
22 to the node or the application.

23       In the preferred embodiments, the server-agent environment is a network  
24 management environment which enables monitoring and management of nodes  
25 of the IT network, which are called "managed nodes". The object to be managed  
26 and monitored may be the managed node, an application (or part of an  
27 application) running on it or a hardware resource needed by the application  
28 (such as a storage disk). The monitoring may comprise passive monitoring (e.g.  
29 collecting error messages produced by the objects) or active monitoring (e.g. by

1 periodically sending a request to the object and checking whether it responds  
2 and, if applicable, analyzing the contents of the response). Management tasks  
3 may be, for example, diagnosis tasks, error correcting or fixing tasks, setting  
4 tasks or other network services.

5 In the preferred embodiments, the server of the server-agent environment is  
6 a management server which controls, administers, records, analyses and/or  
7 displays the management activities and events. The agents are management  
8 agents which respond to monitoring or management requests, perform the  
9 actual monitoring or management operations and/or send event notifications.

10 It has been recognized by the inventor of the present invention that, in the  
11 prior art mentioned at the outset, the agent software is in a relatively insecure  
12 environment since it is distributed over several or all managed nodes in a  
13 network domain (which can involve a whole network). Therefore, an agent could  
14 be target of "reverse engineering". It cannot be excluded that a malicious user  
15 could intercept a switch user call and find out how the agent is able to perform  
16 the switch user and to simulate the behavior with a self-written program.

17 In order to exclude such possible attacks, in the preferred embodiments a  
18 switch user (SU) certificate is generated when a switch user request is received,  
19 using public-key cryptography.

20 In the preferred embodiments, the SU certificate is generated by the  
21 management server, which sends it to the agent. The agent, in turn, forwards  
22 the received SU certificate to a domain controller which carries out the check of  
23 the correctness of the SU certificate and allows the agent to perform the  
24 requested switch user. The management server and domain controllers are  
25 normally in a secure environment and can be seen as save.

26 In the preferred embodiments, the SU certificate is generated with a digital  
27 signature public-key algorithm, such as RSA or DSA. Digital signatures and  
28 public-key algorithms are, for example, described in B. Schneier: "Applied  
29 Cryptography, 2<sup>nd</sup> edition, 1996, pages 34-41, 461-474 and 483-494.

1        In the preferred embodiments, a private and public key pair is available  
2 before the SU certificate is generated. For example, the key pair can be  
3 generated during the set-up of the management system. A renewal of the key  
4 pair can be performed manually or automatically from time to time. Recent  
5 operating systems support key generation; for example, an RSA key can be  
6 generated using the Windows NT Crypto API.

7        In the preferred embodiments, the public key is made public for  
8 "everybody" (i.e. every node and process) within the network or a domain of the  
9 network in which the check of the correctness of the SU certificate is  
10 performed. The publication of the public key can be realized by storing the public  
11 key such that it can be accessed from all the nodes in the network or domain  
12 but cannot be modified by them; only the component which generates the key  
13 pair (e.g. the management server) can modify this information. For example, the  
14 Windows 2000 Active Directory already provides this infrastructure so that the  
15 above-described public key publication can easily be implemented in Windows  
16 2000 domains using the Active Directory (see Windows 2000 Security Technical  
17 Reference, pages 89-151).

18       The generation of the SU certificate comprises signing an SU document  
19 with the private key. The check of the SU certificate comprises verifying the  
20 signature with the public key. There are many public-key digital signature  
21 algorithms with different implementations (see Schneier, pages 39 and 461-  
22 502). In the most common algorithm, RSA, the signing process is called  
23 encrypting with a private key and the verification process is called decrypting  
24 with a public-key. The verification comprises checking the authenticity and  
25 integrity of the transmitted SU certificate. In other words, it is verified that the  
26 SU certificate originates from the management server and that it has not been  
27 modified in transit.

28       Apart from choosing a particular public-key algorithm, there are different  
29 possible ways to actually generate a signature. When, for example, RSA is used,

1 the plaintext SU document (or that part of it which has to be secured) is  
2 encrypted with the public key, and the resulting ciphertext represents the  
3 signature. In order to verify the signature, it is decrypted with the public key.  
4 For the verification, it is sufficient that the resulting decrypting text is  
5 meaningful, since it is a feature of the used strong encryption algorithms that a  
6 decryption with a wrong public key or any modification of the signature would  
7 result in a completely different plaintext with generally no meaning. It is likewise  
8 possible to explicitly check whether the result of the decryption is identical with  
9 the original plaintext SU document, which, for example, can be transmitted  
10 together with the signature and form part of the SU certificate.

11 Since the signing process using the whole (plain) data is generally time  
12 consuming, by preference another possibility is chosen. A relatively unique  
13 representation (also called a "fingerprint" or "message digest") of the data (i.e.  
14 the SU document) is first generated using a process in which the data is  
15 "condensed" or "hashed", for example by means of a message digest function  
16 (e.g. a one-way hash function) into a value of relatively small length, thereby  
17 fixing its contents, and the signing process is performed on the fingerprint,  
18 resulting in an equivalent effective authentication. Therefore, the term digital  
19 signature herein refers to the digital signature of either the plain data element(s)  
20 or of any representation (function) thereof. According to this second possibility,  
21 the transmitted SU certificate is composed of the original SU document in  
22 plaintext and, in addition, the fingerprint of this document, encrypted with the  
23 private key. To verify an SU certificate, the plaintext part of the certificate is  
24 condensed by means of the same message digest function (e.g. the one-way  
25 hash function) and the resulting message digest (hash) value is compared with  
26 the fingerprint decrypted with the public key. If these values are equal, the  
27 authenticity and integrity of the SU certificate is verified. Since the plaintext is  
28 generally bigger than the message digest, the message digest does not uniquely  
29 specify the plaintext - it is possible for many plaintexts to have the same

1 message digest. However, the message digest has the following characteristics  
2 which makes it useful: i) A message digest is one-way, in the sense that, given  
3 a specific message digest, it is computationally unfeasible to find a plaintext  
4 with that message digest. Thus, the correspondence between a given message  
5 digest and a given plaintext can be verified, but the plaintext cannot be  
6 recovered from the message digest. ii) It is computationally unfeasible to find  
7 two messages with the same message digest. Thus, in practical terms, if a  
8 message digest is verified for a given message, it can be assumed that it was  
9 generated from that message. As a result of these two properties, the message  
10 digest can be relied upon as a concise summary of the plaintext, and it can be  
11 substituted for the plaintext in the digital signature algorithm. Suitable message  
12 digest functions are, for example, MD5 and MD4 (see Schneier, pages 429-  
13 459).

14 In the preferred embodiments, the SU certificate comprises the account  
15 name to which the account is to be switched and an identification of the node  
16 for which the switch is to be performed. The account name and the  
17 identification are secured by the signature. In the checking step it is verified that  
18 the node identification actually corresponds to the node to which the switch  
19 user request is directed. This ensures that a certificate may not be used by an  
20 attacker for another node.

21 Preferably, the SU certificate contains no password specific for the account  
22 to which the switch is to be performed. This is because a password-  
23 identification system would require reasonable administrative effort because all  
24 password changes in the network would have to be followed by all network  
25 nodes. In addition, if the password were transmitted with the SU request, an  
26 attacker might be able to catch and decrypt it and use it for malicious purposes.  
27 The password-less switch user functionality of the preferred embodiments  
28 requires little administrative effort and is secure due to the use of the described  
29 switch user certificates.

1        In order to avoid what is called replay attacks, the SU certificate should  
2 also preferably comprise a time stamp and/or another certificate identification  
3 stamp. For example, the time stamp indicates the point of time of the  
4 certificate's generation. When the certificate is checked, it is then also verified  
5 that the certificate is not outdated and/or has not been used before by means of  
6 the time stamp or the certificate identification stamp. For example, if the  
7 "lifetime" of a certificate is defined to be five minutes, the certificate older than  
8 this lifetime would be rejected in the check. A certificate which is younger than  
9 the lifetime will pass this check, however, an additional check is performed as to  
10 whether the certificate has already been used by a different request. To this  
11 end, the component which is responsible for the check stores data (for example,  
12 the certificate identification stamp) of all certificates from the last five minutes.  
13 By comparing the present certificate data with all stored ones, it can find out  
14 that a certificate has already been used, and will then deny the switch user  
15 request. If the present request passes all the checks successfully, the certificate  
16 checking component will store the present certificate's data and will remove all  
17 stored certificate data which is older than the lifetime. Then it will allow that the  
18 switch user is performed.

19       The preferred embodiments of the computer program product comprise  
20 digital program code which, for example, is stored on a computer-readable data  
21 carrier or is in the form of signals transmitted over a computer network. The  
22 preferred embodiments of the program code are written in an object-oriented  
23 programming language (e.g. Java or C++). The program code can be loaded (if  
24 needed, after compilation) and executed in a computer or in networked  
25 computers, e.g. a management server network with managed nodes.

26       Returning now to Fig. 1, it shows a high level architecture diagram of a  
27 preferred embodiment of an object management system 1 which provides a  
28 switch user (SU) functionality. The system 1 is part of a network 2 which  
29 comprises a domain controller 3 and nodes 4, one of which is shown in Fig. 1. A

1 domain constitutes an administrative and security boundary within a network. A  
2 domain controller provides domain-related administrative and security services to  
3 the network nodes and users. For example, it stores domain-wide directory data  
4 (such as the system security policy) and manages user domain interactions,  
5 including user-logon, authentication and directory searches (see Microsoft  
6 Windows 2000 Security, pages 5 and 95).

7 The node 4 is monitored and managed by the object management system  
8 1, and is thus called a "managed node". An application 5 which is monitored by  
9 the management system 1 runs on the managed node 4. The monitored  
10 application 5 can be part of a complex application (for example, an SAP  
11 application) which may be distributed over several nodes. An agent 6 monitors  
12 the application 5. The agent 6 is a program running on a remote device (here the  
13 node 4) that responds to monitoring or management requests from a  
14 management server 7, performs monitoring and management operations  
15 regarding the monitored application 5 and the managed node 4, and/or sends  
16 event notification to the management server 7. In other preferred embodiments,  
17 the agent runs on a remote or external node which is different from the node  
18 which hosts the monitored application. If there are several applications to be  
19 monitored on one managed node, they will be preferably monitored by one and  
20 the same agent. Although there is normally one agent per managed node, in  
21 other embodiments one agent can manage several nodes. The agent 6 is  
22 configured by a set of specifications and rules, called policy for each application  
23 5 to be monitored. A policy tells the agent what to look for and what to do  
24 when an event occurs. For example, according to a particular policy an agent  
25 filters events and generates messages which inform the management server 7  
26 about the occurrence of certain events and/or the status and performance of the  
27 monitored application 5. The agent 6 also implements a feature to start tools or  
28 applications on the managed node 4 from the management server 7. These may  
29 be, for example, diagnosis tasks, error correcting or fixing tasks or setting tasks.

1       The management server 7 provides centralized management services,  
2 processes and/or a management user interface 8 to the management operator  
3 and other users. In particular, the management server 7 collects events and  
4 performance data from the agent 6, processes them and roots the results to a  
5 monitoring console (for example, the user interface 8). The management server  
6 7 also centrally deploys deployment packages, agents and policies, as directed  
7 by the user, and stores definitions and other key parameters. The remote  
8 management tools and applications mentioned above are also started by a user  
9 via the user interface 8 and the management server 7.

10      During the set-up of the operating system or the management system, a  
11 private and public key pair is generated by the management server 7 using the  
12 Windows NT Crypto API. The management server keeps the private key secret  
13 and publishes the public key using the domain controller's Windows Active  
14 Directory, which is designated as public key publication component 9 in Fig. 1.  
15 If the management system operator wants to start a tool on the managed node  
16 4 which requires a switch to another account he is currently using, he initiates  
17 the call to the corresponding tool and the request to switch to the other  
18 account, without providing the password of the account, via the user interface  
19 8. When the management server 7 gets the request, it generates an SU  
20 certificate by means of a certificate generation component 10, using the private  
21 key. The SU certificate 11 is sent by means of a sending component 12 to the  
22 managed node 4 together with a usual call to start the tool under the requested  
23 account. The agent 6 receives the call and forwards the certificate to the  
24 domain controller 3 by calling the Windows NT API. The domain controller 3  
25 comprises a DLL component which is designated as the certificate checking  
26 component 13 in Fig. 1. It is specifically adapted to the management server  
27 system 1 in order to allow a switch to another user account without a  
28 password. The DLL component 13 checks the certificate 11 using the public key  
29 of the management server 7 which is published by the public key publication

1 component 9. If the check reveals that the SU request is acceptable, the DLL  
2 component 13 authorizes the switch user by returning an SU token 14 to the  
3 agent 6. In turn, an account switching component 15 of the agent 6 performs  
4 the switch to the requested other user account, and the agent 6 performs the  
5 tool, according to the request sent by the management server 7.

6 The generation and checking of an SU certificate according to a first  
7 embodiment is illustrated in Fig. 2. At first, the plaintext SU document 21 is  
8 generated which contains switch user identification data. In the shown  
9 embodiment, it contains five such data: A certificate identifier, the name of the  
10 management server, the name of the managed node on which the switch user is  
11 to be performed, the name of the account to which the switch user is to be  
12 performed, and a time stamp. The SU document 21 is then encrypted with the  
13 management server's private key 22. The resulting ciphertext 11' of the SU  
14 document 21 is what is called a digital signature of the SU document 21 and  
15 can be used as the certificate 11 in Fig. 1. The certificate 11' is then transmitted  
16 to the node 4 on which the switch user is to be performed and is forwarded to  
17 the DLL component 13 of the domain controller 3. The DLL component 13  
18 decrypts the certificate 11' using the public key 23, and thus obtains a  
19 decrypted SU certificate 24. If the SU certificate 11' has not been modified  
20 during transmission and has been decrypted with the correct public key (i. e. the  
21 management server's public key), the decrypted SU certificate 24 is identical  
22 with the original plaintext SU document 21. The subsequent step of checking is  
23 carried out using the decrypted SU certificate 24. In particular, it is checked  
24 whether the contents of the decrypted SU certificate 24 is meaningful (for  
25 example, if it contains the correct name of the management server). If this is the  
26 case, the authenticity and integrity of the SU certificate 11' is proven.  
27 Alternatively, it can be checked whether the decrypted SU certificate 24 is  
28 identical with the plaintext SU document 21 (which may be transmitted together  
29 with the SU certificate 11') in order to verify authenticity and integrity.

1 Furthermore, it is checked whether the name of the node indicated in the  
2 decrypted SU certificate 24 corresponds to the node 4 for which the switch user  
3 is requested. Further, it is checked whether the certificate is still within its  
4 lifetime, i. e. whether the time indicated in the time stamp of the decrypted SU  
5 certificate 24 does not indicate a time which lies more than the predetermined  
6 lifetime (e.g. 5 min) in the past. Finally, if the certificate is still within its lifetime,  
7 it is checked whether the certificate has been used before, for example by  
8 comparing the certificate identifier of the decrypted SU certificate 24 with stored  
9 identifiers of those SU certificates which have been processed in the past within  
10 the certificate's lifetime (e.g. within the last 5 min). The certificate identifier is  
11 optional: In other embodiments, there is no certificate identifier, and another  
12 data (for example the time stamp) is used for the comparison. If all these checks  
13 reveal that the certificate is authentic, has not been modified, corresponds to the  
14 correct node, is not outdated and has not been used before, the requested  
15 switch user is accepted, and, therefore, initiated.

16 Fig. 3 illustrates the generation and checking of an SU certificate according  
17 to a second embodiment. As with the first embodiment, the first step is the  
18 generation of the plaintext SU document 21. It contains the same switch user  
19 identification data as the SU document 21 described in connection with Fig. 2.  
20 Different from the embodiment of Fig. 2, a message digest function MD is  
21 applied to the SU document 21, resulting in a fingerprint 25 of the SU document  
22 21, which has a reduced length (for example 128 bits). Then, instead of the SU  
23 document 21, only its fingerprint 25 is encrypted with the private key 22. The  
24 encrypted fingerprint constitutes a digital signature 26 of the SU document 21  
25 according to the second embodiment. The signature 26 is then combined with  
26 the plaintext SU document 21. Their combination forms the certificate 11''  
27 according to the second embodiment, which can be used as the certificate 11 in  
28 Fig. 1. The certificate 11'' is then transmitted to the node 4 and forwarded to  
29 the DLL component 13 of the domain controller 3, as with Fig. 2. The DLL

1 component 13 decrypts the signature 26 with the public key 23, which reveals  
2 the decrypted signature 27. If the correct public key has been used and the  
3 signature 26 has not been modified, the decryption of the signature 26 reveals  
4 the original fingerprint 25. Further, the DLL component 13 generates a message  
5 digest 28 of the plaintext SU document part of the certificate 11''. The  
6 decrypted signature 27 and the message digest 28 of the plaintext part of the  
7 certificate 11'' are then compared. If they are identical, the authenticity and  
8 integrity of the certificate 11'' is verified since any modification of the plaintext  
9 part of the certificate 11'' would result in a different message digest 28 and a  
10 decryption of the signature 26 with a wrong public key or any modification of  
11 the signature would have the consequence that the decrypted signature 27 is  
12 different from the signature 26 and, thus, from the message digest 28. The  
13 other checks correspond to the ones described in connection with Fig. 2 and  
14 need not be repeated here. If the results of all checks are satisfactory, the  
15 requested switch user is initiated.

16 The purpose of the inclusion of the data "name of the server" in the SU  
17 certificates 11' and 11'' of Figs. 2 and 3 is to enable the agents to handle SU  
18 requests from different management servers, each having its own private and  
19 public key pair. Such an environment is also called a Manager of Manager  
20 environment. Since the name of the "certificate holder" is known, the DLL  
21 component 13 is able to check the certificate with the correct key and, thus, to  
22 verify that the request actually comes from a valid management server. It should  
23 be noted that in the embodiment of Fig. 2 the certificate 11' has to contain the  
24 name of the server (also) in plaintext in order to identify the correct public key  
25 needed for the decryption of the encrypted part of the certificate 11'. In  
26 embodiments with only one management server, the data "name of the server"  
27 can be omitted.

28 Fig. 4 shows a flow chart of a switch user method using the certificate  
29 generation and checking method of Fig. 3. In step S1 a private and public key

pair is generated. In step S2 the private key is secretly stored in the management server's secure environment, and the public key is published. The steps S1 and S2 are carried out during system set-up and, optionally, also periodically after the system set-up. Step S3 (and the following steps) are performed when the operator requests a tool and a switch user on a managed node. In step S4, the management server generates an SU document and signs it with the management server's private key. The result is an SU certificate. In step S5 the management server sends the SU certificate to the managed node together with a call to perform the tool under the requested account. In step S6 the agent receives a call with the SU certificate and forwards the SU certificate to the domain controller. In step S7 the domain controller verifies the signature with the public key of the management server. In particular, it verifies that the SU document received by the agent is authentic and has not been modified. In addition, it is ascertained whether the certificate has actually been directed to the correct node, whether it is still within its lifetime and whether it has not yet been used before. If the answers to all these questions are positive, the domain controller returns in step S8 an SU token to the managed node. In step S9, the managed node performs the switch user and starts the tool, as was requested in step S3. If the answer to any of the questions in step S7 is negative, the switch user request is denied in step S10. After steps S9 and S10, the method is prepared to perform another switch user sequence with steps S3 to S9 or S3 to S7 and S10.

Thus, a general purpose of the preferred embodiments is to provide an improved method, computer program product and system for providing a switch user functionality not requiring a password in an IT-network. In particular, the preferred embodiments prevent: (i) an attacker who "catches" a switch user call from gaining relevant information from it, since no password is provided with the call; (ii) an attacker from being able to reuse the call later, because of the provided time stamp; (iii) an attacker from being able to reuse the call on a

1 different managed node, since the certificate contains the name of the managed  
2 node; (iv) an attacker from generating his own call, since the certificate is  
3 digitally signed by the management server and this cannot be done by somebody  
4 else. Thus, the preferred embodiments provide security improvements in a  
5 switch user functionality without a password.

6 All publications and existing systems mentioned in this specification are  
7 herein incorporated by reference.

8 Although certain systems, methods and products constructed in  
9 accordance with the teachings of the invention have been described herein, the  
10 scope of coverage of this patent is not limited thereto. On the contrary, this  
11 patent covers all embodiments of the teachings of the invention fairly falling  
12 within the scope of the appended claims either literally or under the doctrine of  
13 equivalents.

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